USAID Feed the Future Kenya Accelerated Value Chain Development (AVCD) – Potato Value Chain

Endline Survey Report

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Executive summary

Annual survey was conducted to determine the progress the project had made against the set indicator targets in reaching 20,000 beneficiaries by the end of the project (phase 2) through disseminating various technologies to improve productivity, and developing farmer producer organisations. The survey was conducted in two project counties of Bungoma and Taita Taveta to access progress on production and sales including technologies practised by farmers along the value chain. Data collected from the annual survey was analysed and data extracted for reporting annual indicators and other project indicators as stipulated in the impact pathways. From 10 wards selected among the four counties, 257 beneficiaries were interviewed and all had their data analysed for different responses. The interviewed households were drawn from project beneficiaries' database. The design of the survey followed the USAID – AVCD Program: Design Protocol for Annual Monitoring Surveys.

The results from the survey reveal that there has been improvements since the project started. This is confirmed by the number of farmers using quality seed compared to the baseline, increase in the value of sales, increased in the number of hectares under improved technologies and increased number of farmers applying selected technologies promoted by the project. From annual survey results, 46% of the respondents used quality seed, greater than double from the baseline where approximately 15% of respondents used quality seed. As a result of developing localized seed system, the distance travelled to access quality seed reduced to 3 km as compare to the baseline where such quality seed sources did not exist and farmers had to travel 110km to purchase certified seed. On average there was an increase in mean value of sales by 133% to $1,680 from baseline value of $721. In terms of gender, female beneficiaries recorded an increase in gross margin of $1,040 from the baseline compared to male beneficiaries who recorded an increase of $918 from the baseline values. In terms of technologies 98.7% of the respondents applied at least one technology promoted by the project. Thus, the results revealed that female beneficiaries are at par with their male counterparts in terms of the area under various technology practices unlike baseline where there was great disparity in terms technologies applied by different gender categories. Among female aged between 15-49 years, cereal staples or food from cereals was the most consumed food group. Approximately 6.1 food groups on

average was consumed by women of reproductive age, compared to 6.3 in the baseline indicating insignificant difference in terms of the food groups consumed.

Summary of year 3 project indicators from annual survey - Achieved versus target

Indicator	Target	Achieved
HL.9.1-c: (3.1.9.1-2) Women's Dietary Diversity: Mean number of food groups consumed by women of reproductive age (O)	**4**	**6.1**
EG.3-6.-7.-8: (4.5-16,17,18) Yield of targeted agricultural commodities among program with USG assistance	**18t/Ha**	**12t/Ha**
EG.3.2-19: (4.5.2-23) Value of annual sales of farms and firms receiving USG assistance	**$4,000,000**	**$4,929,310**
EG.3.2-18: Number of hectares under improved technologies or management practices with USG assistance (RAA) (WOG)	**1,800**	**6,095**
EG.3.2-17: Number of farmers and others who have applied improved technologies or management practices with USG assistance (RAA) (WOG)	**12,000**	**17,779**

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List of acronyms

AVCD	Accelerated value chain development
DSM	Decentralized seed multipliers
FtF	Feed the future
Ha	Hectares
ODK	Open data kit
S.D	Standard deviation
USG	United states government
VC	Value chain

1.0 Introduction

Accelerated Value Chain Development (AVCD) project is implemented by a consortium of 3 CGIAR organization (ILRI, CIP, ICRISAT) targeting 4 value chains in phase. CIP has been implementing activities for potato value chain since phase 1 (over the last 3 years) and has phase 2 which has been implemented since 2019. The Accelerated Value Chain Development (AVCD) program is a technology driven project, which seeks to apply technologies and innovations in an attempt to increase productivity, increase sales; and contribute to the feed the goal of inclusive agricultural growth, nutrition, and food security in the country in line with the one of the big four agenda of improving food security and nutrition competitively and sustainably. AVCD works closely with other projects and partners to enhance resilience, agricultural productivity, food security and overall economic welfare of farm households, producers and marketers throughout the value chain. While the entry point was scaling up the application of agricultural technologies and innovations, the project sought to address the weakest nodes of the value chain which was expected to benefit all value chain players. The project is being implemented in the potato growing zones of Bungoma and Taita Taveta Counties. Potato value chain intends to leverage on the partnership with various stakeholders, where there will be concerted efforts in addressing the challenges affecting potato production and marketing. Potato value chain has an overall aim of improving income of smallholder farmers as well as improving dietary diversity and food security in the long run.

Project progress is ascertained each year, where data is collected and analyzed for reporting. In order to measure progress, endline survey data is essential since it provides information on before project intervention scenario and thus needs to be collected. One of the ways of collecting baseline data is through surveys. Endline survey was conducted to assess the performance of the farmers before project interventions are made over the last 2 years. Data collected from the baseline is expected to provide information on potato enterprise as well as dietary diversity which AVCD project interventions and progress will be measured against. The project was expected to reach 20,000 beneficiaries by the end of 2 years through various technologies to improve productivity, marketing and income in the potato value chain. The survey was conducted in the potato value chain project counties of Bungoma and Taita Taveta. Its design followed the USAID – AVCD Program: Design Protocol for conducting Surveys.

2.0 Methodology

a) Survey objectives

The objective of this endline survey was to collect data for reporting annual indicators and for the purposes of providing information for tracking project progress after two years of implementation. Specific indicators tracked from the annual survey data are in the table below:

Table 1: List of FtF Indicators tracked annually under PC

No	Indicators	Frequency	Data source
HL.9.1-C	Percentage of female consuming diet of minimum diversity	Annual	annual survey household Questionnaire
EG.3.10,-11,-12	Yield of targeted agricultural commodities among program with USG assistance	Annual	Annual survey household Questionnaire

EG.3.2-26	Value of annual sales of farms and firms receiving USG assistance	Annual	Annual survey household Questionnaire
EG.3.2-17:	Number of farmers and others who have applied improved technologies or management practices as a result of USG assistance (RIA) (WOG)	Continuous /Annual	Annual survey household Questionnaire Event/Monitoring templates
EG.3.2-18	Number of hectares under improved technologies or management practices as a result of USG assistance (RiA) (WOG) (4.5.2(2))	Annual	Annual survey household Questionnaire

Other than the indicators in Table 1, additional data was collected and used to evaluate overall project progress with respect to project objectives, outputs and outcomes. Indicators in Table 1 are mostly collected in the annual surveys and reported after extrapolation to the entire project beneficiaries.

b) Survey area

Annual survey was conducted in 10 wards within the project counties of Bungoma (8) and Taita Taveta (2). The selected wards were: Ndalu, Chesikaki, Cheptais, Namwela, Chepyuk, Elgon, Kaptama and Kapkateny in Bungoma County, Werugha and Wundanyi/Mbale in Taita Taveta County;. Endline survey was conducted between August 26th to September 16th 2020.

c) Sampling

The respondents for this endline survey were selected from a sampling frame of 18,500 potato farmers within the two counties. Multistage random sampling technique was used in which 10 wards from 2 project Counties were selected at random. This was followed by a random sample of 26 respondents in each of the 10 wards selected. The process resulted in the selection of 257 respondents for the annual survey.

d) Sample Size

The total household sample size required in potato value chain annual survey was calculated at value chain level following a well laid down protocol. Key program impact indicators value of sales, yield and dietary diversity were used. The formulae adopted for calculating the sample size was usually adopted when the population size is known. The population of smallholder potato farmers in Bungoma and Taita Taveta counties is approximately 18,500 with a proportion on 0.8 and 0.2 respectively. One of the proposed is that by Yamane 1976, which provides a simplified formula to calculate sample sizes based on the proportions. It has assumptions that are taken into consideration which include:

It assumes that the confidence interval is 93.5%. It also assumes that p is 0.065.

Sample size calculation procedure is as indicated below:

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size and e is the level of precision which is the p value of 0.065.

Once the sample size is ascertained, it is subjected to finite population correction factor now that the population in question is known thus making it finite. The finite population correction factor is calculated as follows:

$$n = \frac{n_0}{1 + \frac{n_{0-1}}{N}}$$

Where n is the sample size (after correction), N is the population size and n_0 is the calculated sample size for the infinite population. The sample size (n_0) can thus be adjusted using the corrected formulae.

The final N = number of respondents required for potato value-chain. Finite population correction factor was used because the large potential beneficiary population size would slightly change the required sample size (n). The total number of respondents selected using the laid down protocol was 257, spread across the 2 project counties. Bungoma had a total of 199 respondents whereas Taita Taveta had 58 respondents.

e) Study Implementation and Quality Control

i) Data Collection Tools

The study employed mobile technology-Open data Kit popularly known as ODK to collect the data where a structured questionnaire was programmed and uploaded into Samsung Tablets. Paper questionnaires were also made available just in case of technical hitches and other operational technicalities.

ii) Training of Enumerators

Enumerators were trained before commencing data collection exercise. This was a 5-day training to master the questionnaire, on probing skills as well as the use of ODK. After theoretical training, enumerators were taken through a pretest to ascertain their mastery of the questionnaire and competency in probing skills to ensure quality data is collected. Issues arising from the pre-test regarding the flow of the questions were addressed before conducting the survey.

iv) Ethical considerations

Each of the identified respondent was asked for the consent before initiating the interview process. They were given assurance on the confidentiality of the information provided.

v) Data Management and Analysis

Data was collected using tablets, reviewed and verified every evening before sending it to the server. It was then cleaned and analyzed using STATA and excel. The findings are presented as percentages or means, depending on the variable type and AVCD FtF indicator reporting requirements. The results were presented in percentages and means for qualitative and quantitative data respectively and compared.

3.0 Survey results

3.1 Demographics and household characteristics

From the endline survey, 257 households were interviewed in Bungoma and Taita Taveta counties out of which 253 provided data suitable for analysis while 4 did not meet the threshold. Approximately 80% of the households were headed by males indicating existence of a patriarchal society, despite this, majority of the project beneficiaries were female. A small percentage of those interviewed were youth, although it was lower than continuous monitoring figures. This was because majority of the youth engage in other activities other than farmers as opposed to full-time potato farmers and could not be easily accessible during the survey. Notably, majority of the respondents were female (61%) while only 40% of the respondents were male (Figure1). From the survey, there was evidence of a higher percentage of male headed households (88%) of the surveyed households. (Figure 1). Over 70 percent of AVCD potato value chain beneficiaries are female indicating their enthusiasm to participate in project activities as they seem more organized than men. Intuitively, it can

be assumed that male headed household have delegated responsibilities to their spouses (female) thus increasing their access to economic resources. This reinforces the idea behind actively including male in promoting gender equity and increased sharing to productive economic resources. The data also reinforces the role of women in reducing rural poverty, improving household nutritional status, and reducing food insecurity among farming households.

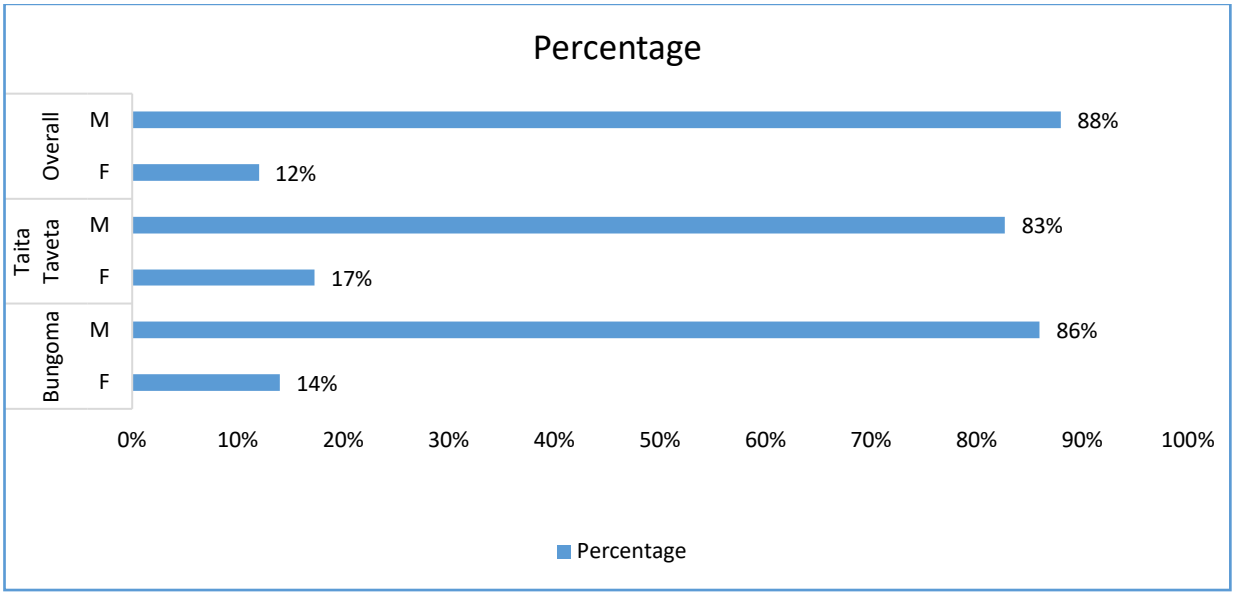

Figure 1: Gender categories of the household head per County in percentage

Most household heads were above the youthful age bracket with an average age of 51 years slightly higher than the baseline (45 years). Youthful household heads were less than 5% (15-29 years) while over 50% were over 50 years. Only 44% of the respondents were between 30 and 49 years. There was no difference in terms of the age between male and female headed household, as both had a mean of 50 years and this conforms to the results from baseline survey. Countywise, male headed household had an average of 48 years in Bungoma and 51 years in Taita Taveta, and the same counties had 51 and 54 years respectively indicating a slight difference (3 years) from the baseline. Female household heads on average were 55 and 53 years , while their counterparts recorded average age of 47 years. The maximum age of the household head in the counties visited was 85 years while the youngest was 21 years. It is interesting to note that though majority of the respondents were female, male had higher area under potato with high commercialization index of 81%. There were no significant difference in age of the farmers compared with the baseline survey despite the efforts of the project to deliberately reach the youth. This is a sign that there are intrinsic factors that hinder the participation of youth in potato value chain development. Alternatively, youth could be more productive in other nodes of the value chain other than production and marketing at farmer level that were not the main focus of the project. Generally, 49% of the households interviewed had a female of reproductive age (15-49 years). Of the surveyed households 9% reported to have children <2 years of age, out of these more than 93% had primary care givers available for the interviews.

Experience in potato production

Potato value chain envisaged to reach farmers in potato growing counties of Bungoma and Taita Taveta though the 2 counties were not among the leading in terms of potato production. However, going into the details there were wards which met the ecological requirements for potato productions albeit not suitable for all varieties.

This inform the implementation process to target farmers there counties hence 20 traditional and 7 nontraditional wards across the 2 counties.

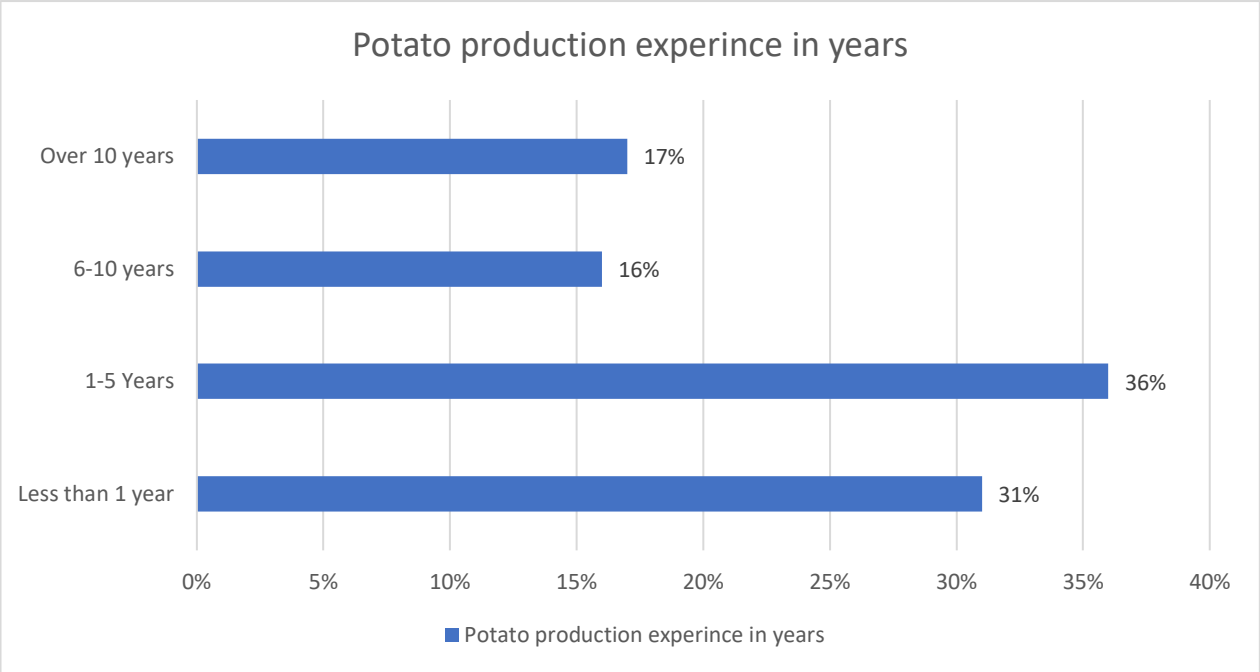

Figure 2: Categories of farmer experience in Potato production

This categorization meant that famers were introduced to potato production. From the survey results in figure 2, more than 65% of the farmers and beneficiaries reached had only less than 5 years in potato production with only 30% having produced potato for a maximum on 1 year. This can be rated as a success in terms on introducing potato production to no traditional wards, particularly for varieties. Only a third of the respondnets indicated to have engaged in potato production for more than 5 years. Figure 2 indicate that beneficairies reached from traditional wards were potato production was introduced at the beginning of the project. With the high number of farmers being introduced to potato productionwithin a short period of time, it is anticiaptred that they will be able to continue with potato production even after the closure of the project with assistance from the county extension system one of the routes to self reliance.

Farmers participation in collective action

Collective action is defined a group of farmers who are driven by a common interest to attain a certain specific goal. Potato value chain adopted a group approach in phase 2 as a lesson from phase 1 in implementing project activities from seed distribution for multiplication, delivery of Agrinutrition training to training on good agronomic practices. This was expected to culminate in formation of an umbrella body in the two counties in form of Potato cooperative to run activities on behalf of the farmers. From the survey results in figure 3, 96% of the respondents participated in collective action whereas only 4% were not group members indicating that they may have benefited from project activities through their own initiative without any mobilization from the WAOs.

Figure 3: Farmers interviewed who were members of potato farmer groups

Over 80% of the respondents indicated that their group benefited from seed packs promoted by the project whereas 16% (Table 1) were not aware if their group did benefit from seed distribution. Intuitively, these farmers may have been inactive in group activities, although these farmers may have benefited from other project activities/ interventions such as participating in the trainings within the learning farms or through Agrinutrition training. Although most farmers were group members, 78% received seed multiplied within by the groups indicating their active participation in groups activities. As envisaged in project design, this active participation provides an indication of the role of collective action in future project intervention as a major driver of dissemination of technologies and other information passed to the farmers.

Following project design, the groups had envisaged to multiply seed and distribute to its members depending on their agreement whether to share after one round or after 2 round of multiplication.

Table 2: Seed multiplication by groups

County	Received seed packs	(n)	Percentage	
Bungoma	Yes	135	76%	100
	No	43	24%	
Taita Taveta	Yes	36	69%	100
	No	16	31%	
Aggregate	Yes	171	74%	100
	No	59	26%	

From Table 2,, the results from the survey indicate that 74% of the respondents were received seed from their groups while only 26% percent did not. This group of farmers who were did not receive seed from the group had majority of them being non-members, whereas the rest to be dormant members of the group. It is important to note that group members who received seed in most groups were active members who participated in the group activities at the multiplication plot. At county level Taita Taveta had a higher percentage of respondents who did not receive the seed while Bungoma had a higher number of those who received the seed. A small number of farmers from the 2 counties also reported to have not shared the seed following their decision to multiply as a group following the first round of harvest in order to maximize on the benefit from the seed received since it is easy to manage quality while it is in one plot.

3.2 Education

Education level to a large extent determines adoption of technology transfer and diffusion of farming techniques among smallholder farmers given the model adopted by the project of conducting training within the learning farms. General education level of the household in Table 3 indicates that majority of the household members had acquired formal schooling. More than 60% of the household heads had attained post primary education. Intuitively, close 23% of the household heads had attained utmost primary level education.

Table 3: Proportion of household heads for various education level categories

Schooling level	(n)	Percentage
No formal schooling	3	1%
Primary incomplete	31	13%
Primary complete	49	20%
Secondary incomplete	36	14%
Secondary complete	97	38%
Vocational/Village polytechnic	3	1%

Tertiary institutions/University	34	13%
Total	253	100%

Surprisingly, 1% of the household heads across in the project Counties had no formal schooling and the other 1% had received formal education from vocational centers/adult education programs. Given the high percentage of literate beneficiaries, there is an expectation that the application of technologies promoted by the project and other agronomic practices will continue beyond the project life in a more sustainable manner.

Land use and crops production

5.1 Land use

Access to and control over land is an important factor to any agricultural production. Farmers in the project counties owned an average of 2.2 hectares of land and dedicated over 70% of it to crop production (1.5 hectares). On average, 26% (Table 4) of arable land was set aside for potato production across the project counties. When compared to baseline survey, proportion of land under potato doubled (from 13%). Arable land in this case includes an aggregate of owned available for farming at household level. Although the increase in the proportion was optimistic, there is an opportunity to increase land under potato production in the future as there is more arable land for enterprise expansion.

Table 2: Mean land and arable land size per household in Hectares

County	Land owned (Ha)	land under crops (Ha)	Land under potato (Ha)		Proportion of land under potato to land under crops	
			Baseline	Endline	Baseline	Endline
Bungoma	2.43(0.19)	2.03(0.16)		0.38(0.03)	20%	24%
Taita Taveta	1.40(0.14)	0.98(0.11)		0.23(0.01)	17%	32%
Aggregate	**2.2(0.16)**	**1.8(0.14)**		**0.35(0.03)**	**13%**	**26%**

** Standard errors are in parenthesis*

In general crop related enterprises dominated land allocations with regards to agricultural enterprises in all the Counties, especially in Bungoma county where land allocated to crop enterprises was slightly over 70% (0.38 hectares). Although potato is slowly gaining inroads particularly in nontraditional wards, it is faced with competing enterprises particularly in the cereal growing areas of the county covered by the project. Notably, farmers preferred skipping potato production seasons as a form of crop rotation technology which the project promotes particularly in traditional potato growing areas of Bungoma. In Taita Taveta county shortage of seed due to emphasis from the training in learning farms on the use of quality seed has resulted in lower percentage of the proportion of land under potato. However, the potential of increasing the land under potato exist if availability of seed is closer to the farmers.

Watering system adopted by the farmers.

In Kenya majority of the farmers depend on rain for any meaningful agricultural production. However, with the changing climatic condition and the evolving agribusiness sector, farmers have opted to invest in irrigation to cushion themselves from total crop loss. From the survey, farmers in the 2 counties were mostly rain depended particularly during the long rains season. As indicated in figure 4, farmers adopted irrigation technology in Bungoma and Taita Taveta counties. This is the is usually the season which rainfall is not adequate and poorly distributed, hence irrigation came in handy to ensure successful crop establishment considering the high investment in seed and other inputs.

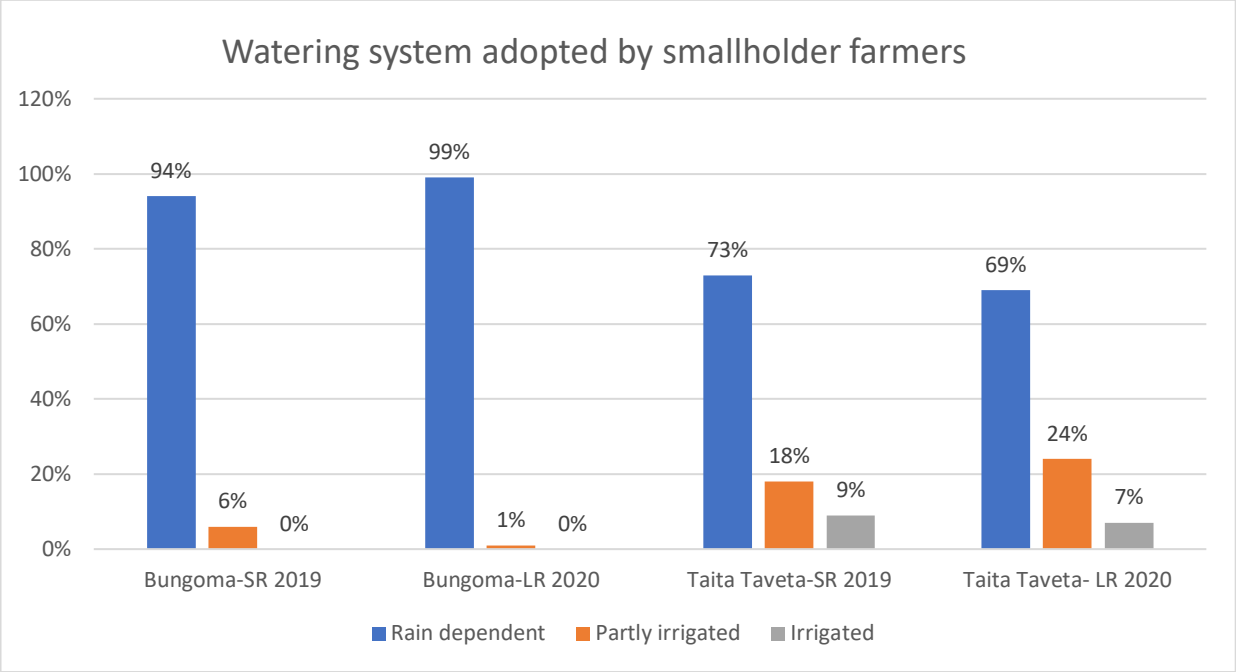

Figure 4: Watering system adopted by potato farmers in the 2 project counties.

Potato production

6.1 Seed use

It is acknowledged that seed is an important component of potato value chain. Endline survey results in Table 5 indicate that approximately 36% of the respondents planted either certified or quality seed potato up from baseline value of only 5%. This 41-percentage point increase was due to the promotion of quality seed as one of the activities promoted by the project. In terms of season, majority of respondents planted either certified seed or quality seed in the short rains reason of 2019, with Taita Taveta recording a drop in the number of farmers during the long rains of 2020. The use of quality seed can also be attributed to the establishment of cooperatives which assisted farmers to procure certified seed collectively. It important to note that this service was not in existence previously.

Table 5: Categories of seed planted by farmers in each county

County	Certified seed		Quality seed		Farmer's own seed		Others*	
	SR 2019	LR 2020	SR 2019	LR 2020	SR 2019	LR 2020	SR 2019	LR 2020
Bungoma	12%	11%	35%	27%	14%	33%	39%	29%
Taita Taveta	65%	46%	9%	20%	6%	11%	21%	22%
Aggregate	19%		27%		22%		31%	
Baseline	5%		0%		62%		33%	

*** Other seed includes neighboring farm, family member or local market – all seed of the average same quality none of which produced under a quality control system.*

Although inroads have been made in terms of access and use of quality seed by smallholder farmers, a larger percentage of respondents (22%) recycled their seed while 31% acquired the seed from other unregulated sources (Table 5). However, access to seed from these sources has reduced since the baseline although there is a chance for further improvement. It is still challenging for the farmers to access certified seed from the 2 counties owing to their geographical location from the certified seed merchants. From the survey, farmers still travel long distance to acquire certified seed with figures not changing compared to the baseline. High transport

cost has increased the cost of acquiring certified seed and may affect farmers journey to self-reliance in terms of access to quality seed.

Unlike during the baseline survey, beneficiary farmers interviewed travelled an average of 258 and 609 kilometers to certified seed sources in Bungoma and Taita Taveta Counties respectively. It important to note that only 3% of the farmers at baseline were aware of certified seed sources but currently 50% of the farmers are aware of certified seed sources though most did not use certified seed because distance hindered access. With regards to quality seed, most farmers in the 2 project counties were not aware of any quality seed multiplier within reach. This gives an opportunity for the project to focus of the development of certified and quality seed sources to improve farmers access to the much-needed quality seed.

From the survey there was a difference in the varieties planted within the potato producing areas of the 2 counties. In Bungoma, Alka was the dominating variety followed by shangi and Tigoni. Most farmers could not clearly understand the other varieties. In Taita Taveta, shangi was the dominant variety introduced by the county government although majority of the farmers interviewd had a negative perception about the variety. Dutch robjyn and Tigoni were among the common varity in Taita Taveta county. Although the variety attributes were not collected, the choice of a particular variety was influenced by certain attributes specitic to a particular farmer.

Table 6: Potato varieties planted by smallholder farmers in the 2 project counties.

	Bungoma county		Taita Taveta		Aggregate	
SR 2019	**(n)**	**Percentage**	**(n)**	**Percentage**	**(n)**	**Percentage**
Asante	-	-	1	3%	1	0.5%
Dutch robjyn	18	13%	3	9%	21	12%
Kabale	15	11%	-	-	15	9%
Kenya mpya	-	-	1	3%	1	0.5%
Shangi	76	53%	9	28%	85	48%
Sherekea	15	11%	2	6%	17	9.5%
Tigoni			1	3%	1	0.5%
Unica	9	6%	14	42%	23	13%
Other*	10	6%	2	6%	12	7%
LR 2020	(n)	Percentage	(n)	Percentage	(n)	Percentage
Asante	-	-	2	4%	2	0.5%
Dutch robjyn	18	8%	3	6%	21	6.2%
Kabale	26	11%	-	-	26	8%
Shangi	128	54%	7	13%	135	40.4%
Sherekea	26	11%	1	2%	27	8%
Tigoni			1	2	1	0.4%
Unica	23	10%	29	55	87	26%
Other*	15	6%	11	20	35	10.5%

Although use of quality seed is gaining popularity in potato growing areas, availability and access to quality seed potato remains a gap. As a result of developing a localized seed multiplication system particularly through groups, there has been an increase in the awareness of the importance of quality seed as compared to travelled by the farmers before the project intervention (Table 8). This model of creating awareness led to an increase in the use of certified seed by farmers through their own initiative for further multiplication.

Seed replacement

Frequency of sed replacement

Table 8: Reason for seed replacement indicated by the respondents.

Count of Rank 1	County		
Rank 1	**Bungoma**	**Taita_Taveta**	**Grand Total**
Better_yield	37%	81%	51%
Get_newvariety	3%	-	2%
high_yield	7%	-	4%
Moa_advice	3%	7%	4%
Resiatance P&D	50%	9%	37%
seed_rplrsn_other	-	2%	1%
Grand Total	100%	100%	100%
Count of Rank2	county		
Rank2	**Bungoma**	**Taita_Taveta**	**Grand Total**
Get_newvariety	18%	4%	14%
high_yield	38%	4%	28%
Marketability	6%	4%	5%
Moa_advice	6%	56%	20%
Resiatance P&D	32%	33%	33%
Grand Total	**100%**	**100%**	**100%**

Approximately 53% of the respondents from the survey replaced seed citing various reasons for the seed replacing their seed. From the data in table 8, it was noted that most respondents chose resistance to pest and diseases as the reason for replacing seed as they believed that new seed at their farm was resistant t pest and diseases. Farmers sought seed that was perceived to give better yield in the quest of improving on their yields. Farmers ranked high yield as one of the reasons to change seed. Majority also cited resistance to best and diseases. Their reason for changing seed were to get new varieties, based on the advice from the ministry of agriculture and also the marketability of the variety.

Production and Marketing

3.6 Total production

Table 11 depicts potato productivity per hectare under different household management settings with different age categories. The reported, average productivity in the 2 counties was 12 tonnes per hectare, which is above

Kenya's 7.9 t/Ha according to FAOSTAT, 2017. Under different management regimes, it was noted that male managed enterprise had the highest productivity as compared to female and jointly managed enterprises. This observation can be attributed to access to productive resources which is crucial management which in most cases difficult for other management categories.

Table 11: Mean potato productivity (t/ha) per household at county level

County							
		Bungoma		Taita Taveta		Total potato	
Gender	Age category	n	Productivity	n	Productivity		
Female	15-29 years	7	10.3	-		7	10.3
	Over 29 years	38	11.8	23	13.6	61	13
Female Total		**45**	**12**	**23**	**10.9**	**68**	**13**
Male	15-29 years	10	8.9			10	8.9
	Over 29 years	78	11.3	19	13.3	97	11.7
Male Total		**88**	**12.1**	**19**	**13.4**	**107**	**12**
Baseline values		**133**	**8.0**	**41**	**6.3**	**175**	**7.7**

Countywise, Taita Taveta had the highest productivity (13.4 t/ha) as compared to Bungoma (12.0 t/ha). This observation confirms the efforts made by the project in increasing productivity through training on GAPs and the emphasis of good quality seed. With regards to age, Table (11) indicates different performance presented by various age categories. Generally, respondents who are youthful (15-29 years) has lower productivity across the 2 counties under different management categories. Notably, respondents above the youthful age performed better as competed to mixed and youthful age categories. Age is a proxy for accumulated wealth and potato farming experience thus explaining the high productivity among farmers who are over 29 years. This observation was similar across the project counties.

Based on the baseline figure at the, there has been an improvement of 56% indicating the efforts of project intervention to bridge the gap and even surpass the set targets.

Table 12: Mean productivity of traditional and nontraditional areas of Potato production

County	Subcounty category	Gender			Baseline values		
		Male	**Female**	**Average**	**Male**	**Female**	**Average**
Taita Taveta	Non traditional	-	-	-	-	-	-
	Traditional	13.4	11.0	13.0	6.5	6.2	6.3
Bungoma	Non traditional	11.9	7.4	12.1	8.0	6.9	7.8
	Traditional	10.9	13.1	12.3	7.7	9.0	8.2
Average Traditional		**11.5**	**12.3**	**11.55**	**7.9**	**7.2**	**7.4**
Average Non-Traditional		**11.9**	**7.4**	**11.33**	**8.2**	**7.7**	**7.8**

To support the Theory of Change, the potato value chain has been promoting potato production and marketing in 17 nontraditional wards where potato is grown at a very low level or not at all due to the agro-ecology, and in 10 traditional potato-producing wards where potato is commonly grown due to conducive highland, high rainfall agro-ecology. With

regards to the productivity, traditional wards higher productivity and this is justified by the experience in potato production as opposed to new (non-traditional wards). However, the performance on nontraditional wards is commendable considering the inexistence of potato in those counties.

3.7 Total quantity of sales

Participation in crop marketing is a proxy of commercialization index among smallholder farmers. From the baseline survey, 67% of the respondents sold their produce with an average of 7.9 t/ha and an average of 70 percent of the total production. There was insignificant difference in terms of the mean quantity sold within the 2 counties.

Table 12: Mean quantity of potato sales per household (t/ha)

Management categories	Age categories	County				Overall Total	
		Bungoma		Taita Taveta			
		N	Quantity(t/ha)	N	Quantity(t/ha)	N	Quantity(t/ha)
Both	15-29_years	3	1.6			3	1.6
	Over_29_years	4	4.8	6	5.1	10	5.0
Both Total		7	3.4	6	5.1	13	4.2
Female	15-29_years	2	9.8			2	9.8
	Over_29_years	30	6.7	9	2.7	39	5.8
Female Total		32	6.9	9	2.7	41	6.0
Male	15-29_years	1	7.9			1	7.9
	Over_29_years	67	5.8	6	8.8	73	6.1
Male Total		68	5.9	6	8.8	74	6.1
Overall Total							
Baseline values		107	6.0	21	5.1	128	5.9

With regards to management categories, male managed field had the highest (10t/ha) as compared to jointly managed and those managed by female (5.7t/ha) respondents. In terms of the age, youthful farmers in general have lower quantity sold per hectare under joint management. Under female managed fields, youthful farmers had better performance than older farmers, whereas men over 29 years performed better than youthful farmers. Interestingly, there no youthful farmers in Taita Taveta who sold their produce.

Table 9: Mean quantity sold(tonnes) and value of sales at household level.

County	Quantity sold		Sales (USD)		Annual Total	
	Mean	S.D	Mean	S.D	Mean	S.D
Bungoma	0.38	0.29	0.36	0.21	0.37	0.25
	0.19	0.26	0.17	0.11	0.18	0.2
Taita Taveta	0.13	0.02	0.11	0.05	0.12	0.04
	0.19	0.18	0.15	0.26	0.17	0.22
Overall mean	0.22	0.19	0.20	0.16	0.21	0.19

3.8 Value of annual sales

As indicated by the proportion of sales to production, potato has a higher commercialization index underscoring its importance as a commercial crop among smallholder farmers at household level. Table 13 depicts the gross revenue per hectare disaggregated by gender and age per county. In terms of management by gender, male

managed potato enterprise had the highest gross revenue per hectare ($3,107) compared to the jointly and male which had $1,711 and $1,352 respectively. The average unit output price per kilogram was $0.34, with 0.28 and 0.4 in Bungoma and Taita Taveta Counties, respectively. The high price unit price in Taita Taveta is as a result of unique geographical location coupled by the gaps in supply and demand unlike Bungoma county which is affected by seasonal price variations and effect of excess supply in the markets from other potato growing regions of Kenya.

Table 13: Mean value of sales per household in USD/Ha disaggregated by gender

Management categories	Age categories	County				Grand Total	
		Bungoma		Taita Taveta			
		n	Sales USD/Ha	n	Sales USD/Ha	N	Sales USD/Ha
Female	15-29 years		-	1	588		-
	Over-29 years	12	1606.2	3	2644.8		1813.9
Female Total		12	1606.2	4	2644.8		1,352.2
Male	15-29 years	5	1297.5	-			1179.3
	Over-29 years	118	1,494.6	37	2553.0		1747.
Male Total		123	1486.6	37	2501.3		1726.1
Grand Total			1497.2		2511.2		1733.6
Baseline			1,858.8		2,868.2		2,028.3

Generally, youthful farmers had lower unit prices and gross revenue per hectare as compared to their counterparts who are over 29 years. The plausible reason for this observation is that age is a proxy for experience in farming. Its widely acknowledged that farmers who have experience in marketing of their produce get better prices as opposed to young and inexperienced farmers. From the results, respondents had higher value of sales in the baseline than in the endline.This is because farmers saved more seed since most of the seed used for planting were of high quality. The group seed multiplication approach induced farmers to multiply seed in their own seed plots thus reducing on the quantity of potato sold.

Table 10: Types of traders engaged by smallholder farmers in the 2 project counties.

Buyer type	Season	
	LR 2020	SR 2019
Consumer	8%	7%
Broker	20%	25%
Farmer	9%	11%
Small traders	44%	41%
Large traders	7%	7%
Institutions	1%	1%
Restaurant	6%	3%
Other	4%	6%

Most farmers in both seasons sold their produce to small traders. These are the traders who engage them in the local market. Although brokers facilitate the marketing process, they had over 20% market share in both seasons. Unlike conventional marketing of agricultural produce in Kenya, brokers played a role in buying the produce the selling it to other producers at a margin. Consumers were mainly households who purchased the produce for home consumption, and this was mainly common in non-traditional potato producing wards of

Bungoma and generally Taita Taveta. Large traders (purchasing ware potato in bulk) controlled a smaller market share of 7% and were mainly dominant in traditional potato producing ward of Bungoma county. Seed business between farmers was commendable with 9% of the farmers sold through this channel. This is evidence that farmers shared planting material either as quality seed or farmers' own seed.

Other players in the market were restaurants who controlled 6%, while institutions and others controlled 1% and 4% respectively.

3.9 Technologies application and adoption

Potato value chain promotes a bundle of technologies applied by farmers at different nodes of the value chain by smallholder farmers. Technologies promoted by potato value chain include crop genetics, cultural practices, irrigation, post-harvest handling, pest and disease management. Crop genetic is an aggregation of the respondents who planted good quality seed and use of apical rooted cuttings, whereas cultural practices included application of crop rotation, seed plot technologies and other seed selection strategies. From the survey results, approximately 71% of the respondents applied at least one of the technologies promoted by the project. As indicated in figure 4, the majority of farmers who applied 2-3 technologies and this was applicable across the counties

Surprisingly, 6% of the respondents applied all the 4 technologies promoted by the project with majority of respondents from Taita Taveta applying the 4 technologies. However, there were a number of farmers Bungoma who did not apply any technology, and this was mainly in from the non-traditional potato producing areas, despite the exposure from the seed distribution activity. It is worth noting the progress made by the project in terms of technology adoption given the fact that adoption takes time.

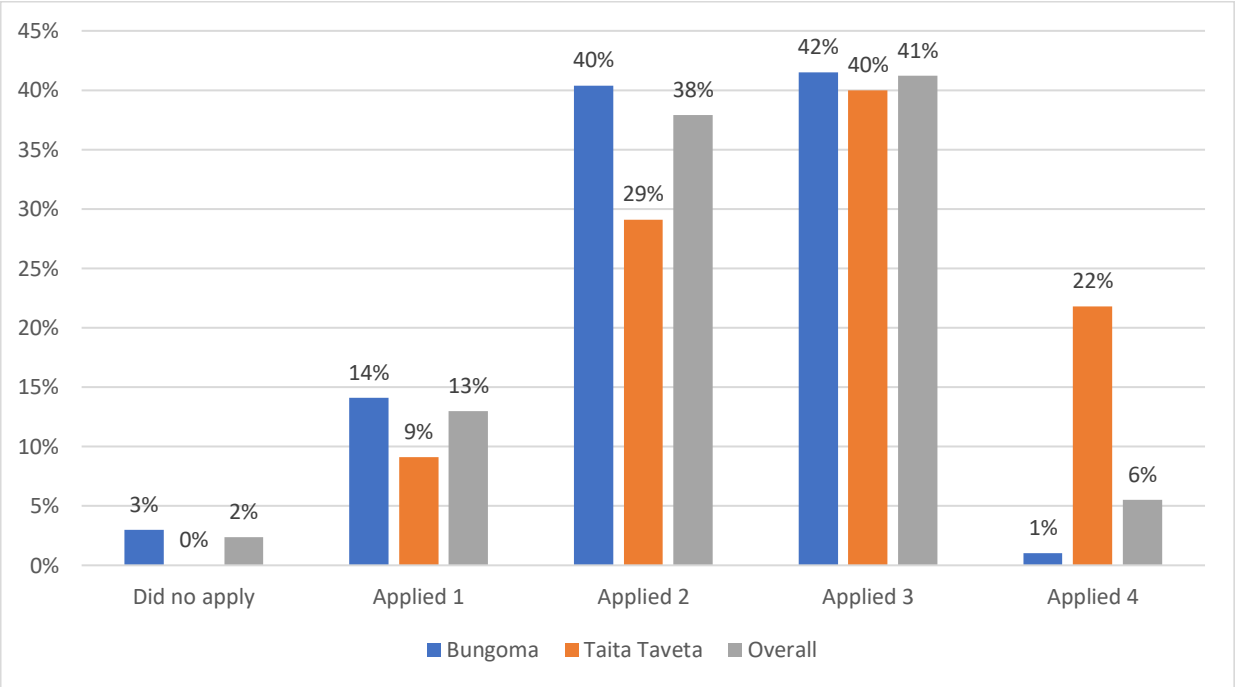

Figure 5: Proportion of respondents applying bundles of technologies

3.9.1 Application of crop genetics technology (use of certified and quality seed)

Crop genetics technology is reported when a respondent used either certified seed, quality seed or both. Approximately 17% of the respondents applied crop genetics technology with only 6% using at least certified

seed and quality seed in Bungoma. The exposure to use of quality seed in Bungoma is mainly through other projects implemented by other institutions within the county though not on a larger scale. In Taita Taveta, at least 58% of the respondents applied crop genetics technology. The high number of farmers applying these technologies in Taita Taveta is as a result of the promotion of quality seed use by the county government in the last financial year. In terms of age category, majority of technology appliers are male and female respondents of above the youthful age (over 29 years) with few of the appliers managing their plots jointly.

Although the percentage of technology appliers seems high for Taita Taveta County, it was observed that the area under technology is low. From annex 1, the mean land size in Taita Taveta is 0.03 hectares. There was limited variation in terms of area under crop genetics within the 2 counties. Jointly managed plots in Bungoma County had slightly a higher area under?|technology of 0.05 on average and 0.08 for those managed by respondents over 29 years. From the baseline, it was found that minimal area was managed by youth with a mean of 0.01 hectares in Bungoma being managed by the youth. Female respondents had the lowest hectarage in Taita Taveta compared to the county average.

Table 13: Mean area under crop genetic by County per gender

		County				Overall mean	
Gender	**Age categories**	**Bungoma**		**Taita_Taveta**			
		n	Mean area Ha	N	Mean area Ha	N	Mean area Ha
	15-29 Years						
Female	Over_29_years	5	0.05	10	0.09	15	0.06
Female Total		5	0.05	10	0.09	15	0.06
	15-29 Years		0.08		0.10		0.09
Male	Over_29_years	4	0.07	11	0.06	15	0.07
Male Total		5	0.07	11	0.06	16	0.07
Overall mean			0.07		0.07		0.07
Baseline mean values			0.05		0.01		0.03

Generally, there was limited use of area under technology particularly with regards to the proportion of area under potato. This is coupled by nonexistence of near quality seed multipliers and limited knowledge on the availability certified seed particularly in Bungoma county.

3.9.2 Application of cultural practices technologies

Cultural practices comprise of three technology practices which include crop rotation, saving seed on farm using seed plot technique or positive selection and hilling. A respondent was considered to be applying cultural practices technology if at least one of the listed technologies was applied. From the total respondents, 72% of the farmers interviewed applied cultural practices technology. A higher proportion of appliers of this technology were from Taita Taveta county (85%) whereas Bungoma had 66% of the respondents practicing cultural practices technology. Out of the 3 cultural practices, crop rotation had the highest number of appliers, followed by positive selection and lastly seed plot technology. Most of the respondents interviewed indicated applying more than one cultural practice technology on the same piece of land. In terms of land size under cultural practices technology, Bungoma county has 44.5 hectares of land whereas Taita Taveta had 7.3 hectares under cultural practices technology. With regards to each technology sub-category of cultural practices; 41.6 hectares was under crop rotation, 0.49 under positive selection while 2.4 was under seed plot technology. Generally, there was no significant difference in the area under cultural practices technology under various management categories and age categories.

Table 14: Mean area under cultural practices per County per gender

Gender	Age categories	County				Grand Total	
		Bungoma		Taita Taveta			
		n	Area in ha	n	Area in ha	n	Area in ha
Female	15-29 years		-			-	-
	Over 29 years	28	0.14	13	0.09	40	0.350.13
Female Total		**30**	**0.14**	**13**	**0.09**	**43**	**0.13**
			0.12		0.20		0.13
Male Total	Over 29 years	40	0.33	16	0.14	56	0.27
	Overall mean		**0.30**		**0.14**		**0.27**
Baseline mean		**120**	**0.37**	**46**	**0.16**	**166**	**0.31**

3.9.3 Irrigation technology

Irrigation is the most important component of agriculture to minimize weather related fluctuations likely to affect crop productivity and ensure sustainable agriculture. Irrigation technologies irrigation was considered one of the technologies adopted by farmers to mitigate against the effect of climate change (low precipitation), in which 7% of the respondents were recorded as appliers. Each qualifies as an applier if the crop was fully or partly irrigated. Close to 18 % of the respondents from Taita Taveta practiced irrigation technology whereas only 4% in Bungoma County practiced some form of irrigation. This observation reinforces the fact that farmers depended on rainfall for their agricultural production and also it indicates that there is limited investment in irrigation technology.

Table 15: Mean area in hectares under irrigation technology by county per gender

Gender	County					Overall Total	
	Age categories	Bungoma		Taita Taveta			
		n	Mean area (ha)	n	Mean area	N	Mean area
Female	15-29 years	1				1	0.03
	Over 29 years	5	0.08	4	0.03	9	0.12
	Female Total	6	0.08	4	0.03	10	0.11
Male	15-29 years		0.03		0.12		0.10
	Over 29 years	1	0.03	2	0.08	3	0.22
	Male Total	1	0.05	2	0.12	3	0.10
			0.04		**0.12**		**0.10**
Baseline values		**7**	**0.21**	**9**	**0.05**	**16**	**0.12**

For those respondents who applied irrigation technology, most of the irrigation systems had been installed in the prior seasons and was only useful when there were inadequate rains and was only applicable where there were permanent source of water. Irrigation technology is applied as a way of adapting to climate change, particularly low precipitation. From the results, a total of 0.77 hectares were under irrigation (Table 14). Irrigation requires substantial investment which the youth may not be able to invest in due to resource constraints. With regards to management categories, plots managed by youthful farmers had a lower land size under irrigation with male managed household and this could be explained by access to productive economic resources. Generally, investment on irrigation technology was found to be dependent on weather patterns and general investment in the enterprise as farmers would try to avoid losses thus adopt irrigation technology.

3.9.4 Pest and disease management

Pest and disease management is critical for success for any crop enterprise. From the endline survey results, the average land size under pest and disease technology was 0.14 hectares. Bungoma had a mean of 0.17 hectares and Taita Taveta 0.06 hectares (Table 16). Farmers who applied appropriate fungicides in their potato fields were deemed to be applying disease management technology whereas Pest management in this case implies application of improved pesticides and insecticides in potato fields at household level with prior knowledge of application by the farmers.

Table 16: Area in hectares under pest and disease management technology by County per gender

Gender	County						
	Age categories	Bungoma		Taita Taveta		Overall Total	
		N	Area in Ha	n	Area in Ha	N	Area in Ha
Female	15-29 years	2					
	Over 29 years	24	0.18	13	0.05	37	0.07
Female Total		26	0.13	13	0.05	39	0.1
Male	15-29 years	2	0.11		0.10	2	0.11
	Over 29 years	53	0.18	22	0.06	75	0.16
Male Total		55	0.18	22	0.006	77	0.15
			0.17		0.06		0.14
Baseline values		109	0.18	43	0.03	152	0.13

Pest and disease management technology was by high number of farmers (45%). Male managed fields under pest and disease management technology had a higher area (0.18 hectares) under pest management technology compared to and female managed fields.

In terms of mean area under pest and disease management technology, farmer within the youthful backet (15-29 years) had the lower mean area 0.07 hectares. In other management and the age categories, there was no significant difference in terms of the land sizes under peat and disease management technology under different gender categories. It was noted that pest and disease management is a new concept in nontraditional potato growing areas since there is limited understanding potato production despite trainings within the learning farms which is expected to take loner for its application to create an impact.

Training and capacity building

There were several questions in the structured questionnaire designed to capture the extent and nature of farmers' participation in training at the learning farms. Training provided through extension workers was deemed to be a key driver in exposing farmers to technologies and nutrition messaging. This exposure was expected to improve adoption of technologies promoted by the project and nutritional status of the households. Results from the endline survey reveal that over 90% 0f the respondents attended at least one training activity on good agronomic trainings and approximately 56% had nutrition training. Although both were provided jointly t the learning farms, some of the respondents could not recall attending a nutrition training session.

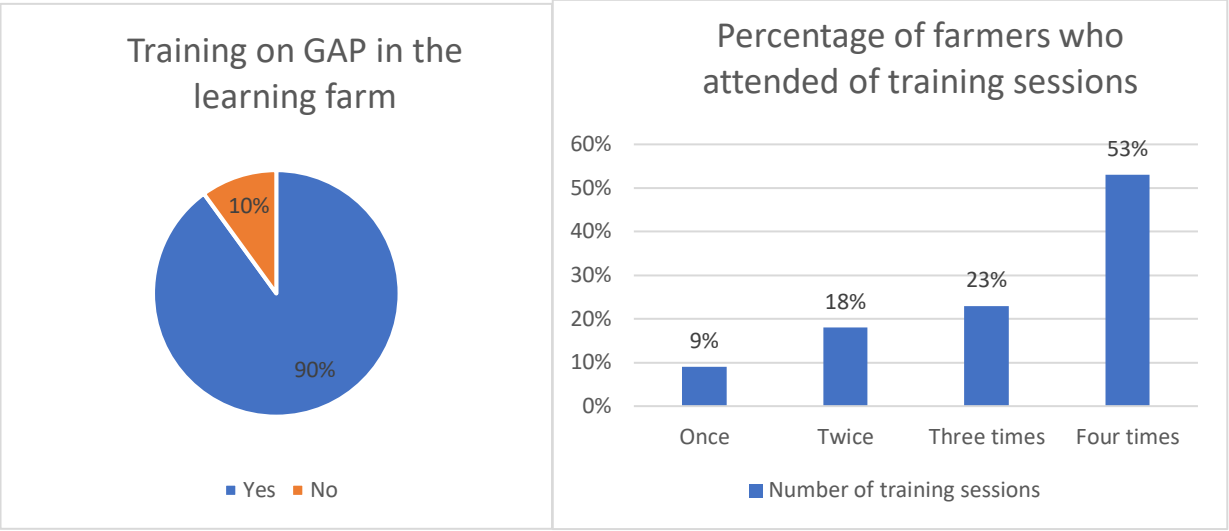

Figure 6:Percentage of farmers participating in capacity building sessions.

Training at the learning farms were provided in several times at intervals with a total of 4 training sessions. From the survey over 53% of the respondents had attended all the 4 training sessions while only 9% attended training only once. This observation underscores the strategy used by the project in reaching out to farmers at designated learning farms.

Dietary Diversity

9.1 Household Dietary Diversity

According to the theory of change, nutrition interventions were designed to affect the quality and diversity of feed consumed at household level thus improving on the nutritional status trainings were conducted at the learning by trained Community health volunteers (CHVs) alongside good agriculture training. Agrinutrition training covered 14 cards compressed into 7 sessions. From the survey, approximately 63% percent of the respondents participated in Agrinutrition training. Interestingly more than 50% (annex 1) of the respondents attended at least half of the sessions training sessions with the average training of 4 in Bungoma and 5 in Taita Taveta. Although Agrinutrition training was deemed as way in which beneficiaries will receive and implement, the dietary diversity did not change from the baseline. This could be interpreted as difference in timing while conducting nutritional studies as it should be conducted at lean periods. From the survey results most consumed food groups at household level were cereals, vegetables, milk and milk products and condiments. Least consumed food groups were fish& sea foods, meat, and eggs. These least food groups were mainly purchased by the households.

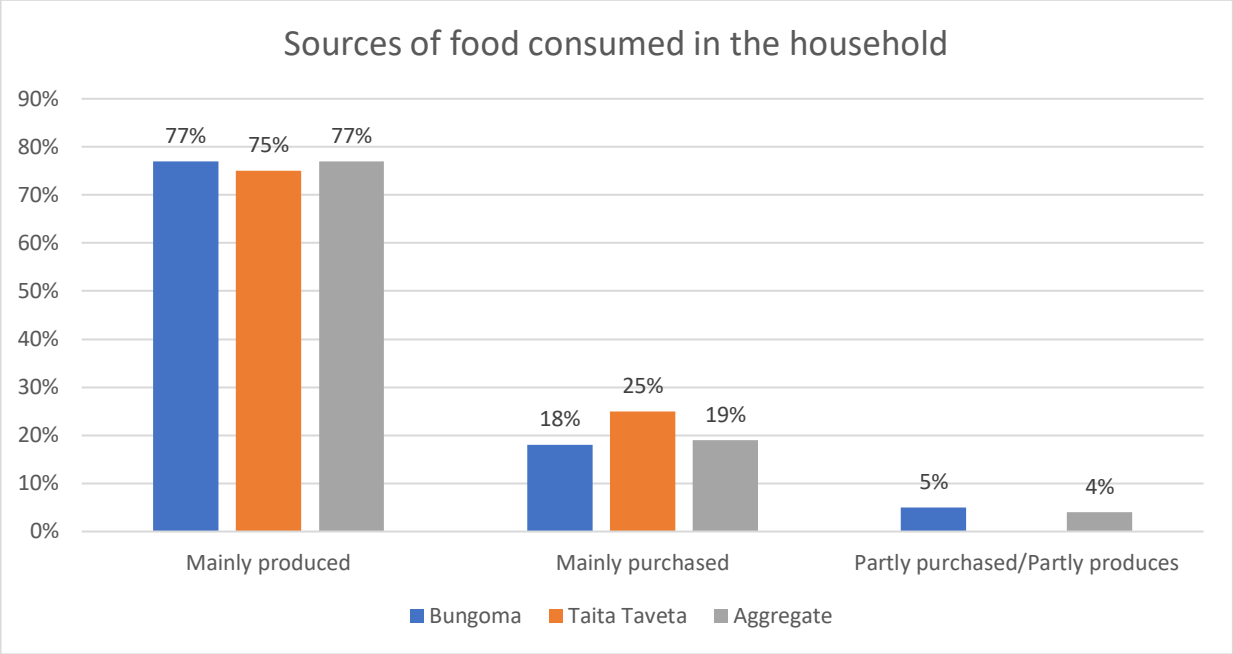

Figure 7: Percentages on the main sources of food consumed at household level.

Food consumed in Kenyan households are produced, purchased, partly purchased/produced and from donations. From the survey, most of the respondents (77%) consume food mainly produce their farms. This is a good indicator for potential dietary improvement in dietary diversity since it is cheap. As indicated in figure 8, one quarter of the households in Taita Taveta indicated their reliance on purchased food as opposed to consuming produced food. Generally, 19% of the respondents depend on mainly purchased food. This observation augers well with potato value chain theory of change as it was expected that the extra income generated from the sale of potato will be used in purchasing nutritious food. It the observation, most of the household s consuming purchased food in Bungoma were from high altitude areas where mainly produced cereals take longer to produce hence depend on their main commercial crop (Potato) for income that will be used in purchasing food.

9.2 Mean number of food groups consumed by women of reproductive age (S)

From the annual survey, 53% of the households visited had a woman of reproductive age to respond to food groups consumed over the last 24 hours. On food consumption among female aged between 15-49 years, food group 1 containing grains, roots& tubers and bananas is the most consumed food group, followed by milk & milk products. Fish and organ meat are the least consumed food groups among the women of reproductive age (Table 22).

Table 3: Mean dietary diversity for women of reproductive age.

Bungoma			Taita Taveta			Aggregate		
(n)	No. of food groups	Percentage	(n)	No. of food groups	Percentage	(n)	No. of food groups	Percentage
5	3	4%	4	3	4	7	3	32
25	4	18%	35	4	31	9	4	41
51	5	39%	53	5	47	3	5	14
35	6	26%	17	6	15	2	6	9
13	7	9%	2	7	2	-	-	-

1	8	1%	1	8	1	1	8	5
4	9	3%	-	-	-	-	-	-

On average, women of reproductive age consumed 6 food groups 5.2 with slight variation from the baseline value which was also 5. As it was in the baseline, 78% of the females consumed at least 5 food groups.

9.3 Mean number of food groups consumed by children of 6-23 months of age.

Among children under 2 years, cereal staples or food from cereals and milk & milk products are the most consumed food group. Fish and organ meat are the least consumed food groups among the children under 2 years consumed. Most of the food groups consumed with women of productive age are almost similar with the food consumed by children under 2 years. All the children under 23 months were between 8-23 months with all of them consuming solid or semi-solid food. It is interesting to note that most children were introduced to solid or semi solid food after the age of 6 months. This reflects the adoption of messages received by caregivers from Agrinutrition training sessions.

Table 17: Mean number of food groups consumed by children 6-23 months old.

County	[redacted]			
Number of training sessions				
[redacted]	**(n)**	**No. of sessions**	**(n)**	**No. of sessions**
Bungoma	110	4.2	-	-
Taita Taveta	50	5.2	-	-
Grand Total	**160**	**4.5**	**-**	**-**
Dietary diversity for household level				
[redacted]	**(n)**	**No. of foods groups**	**(n)**	**No. of foods groups**
Bungoma	196	7.8		
Taita Taveta	46	7.2		
Grand Total	**242**	**7.7**		

With regards to dietary diversity, 88% of the households visited had the main food preparer who was instrumental in responding to food consumed at household level questions. The mean household dietary diversity was 6.1 food groups for 24hr recall period at household level (Table 21). The range was from 4-9 food groups per household. This indicates that there was no significant change from the baseline values, where the mean food groups consumed by a household was 6.3.

Potato consumption

Although potato is a crop that depends on weather conditions for its successful production, the results indicated that it is gaining popularity as one of the stable foods. As indicated form the survey results, over 90% of the respondents are consumers of potato with 10% consuming it at least 6 days of the week whereas more than 60% including it in their diet at least 2 times a week with only 11% of the households consuming potato occasionally. Dietary diversity score confirms that indeed potato is a major household food give the percentage of household consuming it.

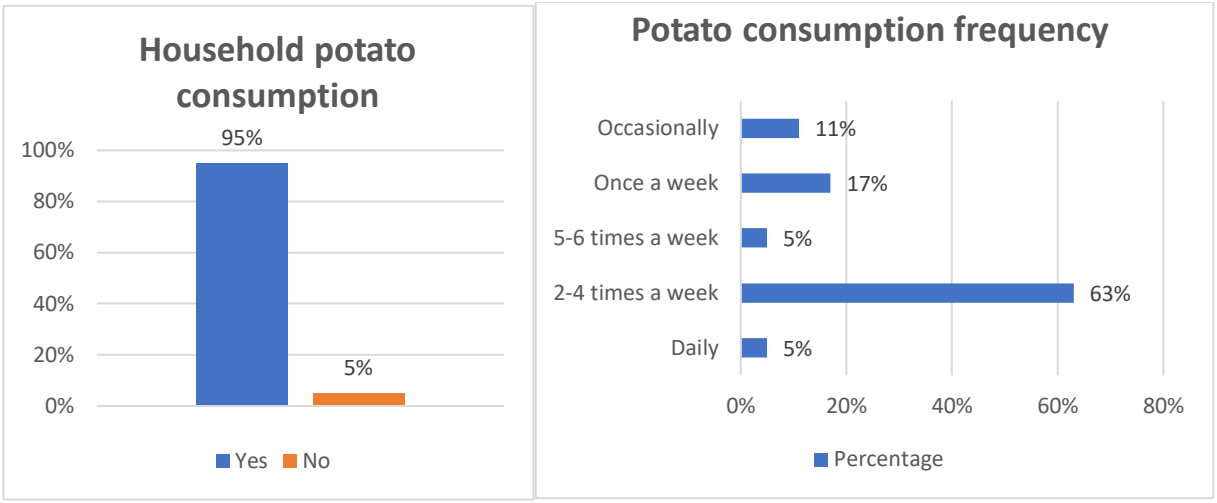

Figure: Potato consumption frequency at household level

Conclusion

From the annual survey results, it is evident that there was an improvement in most of the project indicators as compared to baseline values. There was no difference in household demographics as there was insignificant difference with baseline results.There was an increase in the number of farmers using quality seed. Its also key to note that there was an increase in the value of incremental sales and an incease in the gross margin when compared to the baseline values. There was a slight increase in the number of farmers applying technologies compared to the baseline values. However, there was an insignificant difference in terms of the food groups consumed by women of reproductive age and children blow 2 years when compared to the baseline values.

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Annexes

Annex 1: Annual survey 2018 Tables.

1.1 Table; Sample size calculation for the annual survey

Indicator	Summary of sample size calculation for annual monitoring surveys					Final sample size (including 10% for 'drop-out')	
	Target change in indicator (% of mean)	Expected standard deviation (% of mean)	Intra-ward correlation (ICC) (0 - 1)	Required number of Wards	Required sample size per Ward (average)	Sample size per Ward	Total sample size per value-chain
Gross margin from commodity [USD]	15	35	0.10	**12**	23	**26**	312
Dietary Diversity [0-1]	20	46	0.10		21		

International Potato Center CIP- Sub-Saharan Africa Region

Potato AVCD Endline-Survey questionnaire 2020

CONSENT STATEMENT

My name is […….]. I am from international potato center (CIP) and we are carrying out Endline-survey for Accelerated Value Chain Development project-(AVCD] potato value chain within your County. You have been randomly selected from a pool of beneficiaries to participate in this survey. Your participation is voluntary and the information we get from you will be treated confidentially. It will be reported together with those of other participating respondents, and your name and contact or that of your family will not be specifically identified/mentioned in the report. The findings of this study will help us and our partners, including the County government, with which we collaborate, to better understand the progress and the impact of the project.

You may choose to answer or not answer any question and you are free to withdraw from further participation in this interview at any time. In case you decline/withdraw, your lack of participation will not have any negative consequence on you, nor will it prevent you from benefitting from the activities that are being undertaken by us, our partners or the government to improve potato industry. We would, however, really appreciate your participation and completion of the interview, and your honest answers to the issues we shall discuss.

If you have any further questions about this research, you can contact my supervisor [name] directly on tel. [0711033677/0711033674.].

HHID_____

The interview will take about one hour to complete. Do you have any questions right now?

With your permission/consent, I would like to start the interview. May I now proceed to start the interview?

Name of the respondent _____

Signature of the respondent _____ Date _____

HHID_____

SECTION 1

A. Household identification

A1. Unique Identifier:	HHID …….
A2. Date of Survey (DD/MM/YYYY):	A3. Enumerator Name:
A4. Head of Household Name:	A5. Head of household gender: Male/Female
A6. Mobile number:	A7. National ID for household head:
A8. Did the household consent to the interview? (1=Yes 0= No) ……	A9. If no, why? (Code A)
If no, end the interview and request replacement from survey coordinator; take (GPS coordinate)	
A10. County Name:	A11. Sub-county Name:
A12. Ward Name:	A13. Village name:
A14. Name of survey Respondent:	A15. Respondent Gender: 1=Male and 0=Female
A16. Relationship of survey respondent to Household Head (code b):	
a) No Consent	**b) Respondent relationship**
1 = Respondent refuses to participate 2 = Respondent does not have the time 3 = Household head (or other knowledgeable member) is not present at the house 4=Other: (specify in cell)	1 = household head 2 = spouse 3 = other family member 4 = other non-family member

Screening questions

A17	How long have you been engaged in potato production			_____ Years
A18	Did the household grow any potato between September 2019 and August 2020	1= Yes 0=No	**A19**	1= Yes, 0=No; _____. If no discontinue the interview and request for replacement
A20	Is there a child who is **less than 2yrs old** in this household? (1=Yes. 0=No)	1= Yes 0=No	**A21**	Is there a mother or primary caregiver of this child under 2 years? (1=Yes. 0=No)
A22	Is there any female member of this household?		**A23**	Distance to nearest food market _____ km
A24	Distance to the nearest seed source in Km		1=Certified seed _____ km 2=DSM/VPA seed _____ km 3=Farmers 'own seed' _____ km 4= Neighbors _____ km 5= Market _____ km	
A25	Distance to the learning farm where you received training? _____km			
A26	Are you a member of AVCD project Farmer Group? [1] Yes [0] No			
A27	If yes to A26, did your Farmer Group receive potato seed distributed by the project? [1] Yes [0] No			
A28	If A27 is affirmative, were you given some seed by your group to multiply on-farm? [1] Yes [0] No (*This applied seed retained by group multiplied for more than one season*)			

HHID_____

B. DEMOGRAPHIC CHARACTERISTICS OF HOUSEHOLD MEMBERS

Q1: Please provide information on household characteristics in the table below

Member ID	Name of HH member	In which **year** was this person born?	What is the **gender** of member? ***1=male 0=female***	Marital Status *See codes below*	Relationship to current head *See codes below*	What is the highest level of education completed? *See codes below*
Memid	**Hhmem_name**	**YoB**	**Gender**	**Mstatus**	**Rhead**	**Heduc**
1 (head)						
2 (spouse)						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

Demographic table codes

Relation to head (rshead) 1= Head 2=Spouse

Marital Status (mstatus) 1=Single 2=Married 3=Divorced 4= Widowed 5= Separated 6= Other

Education levels (heduc) 0= None, 1= Primary incomplete, 2=Primary complete, 3= Secondary incomplete, 4=Secondary complete, 5=Vocational/village polytechnic 6=College and tertiary institutions, 7 =University, 8= Adult education.

SECTION 2.

In this section, please provide information on potato production in the table below.

Q 2.1: Please provide information on access to land in the table below for the SR 2019(Sept 2019- Feb 2020) and LR 2020(March-Aug for Bungoma and Taita Taveta County *(Disaggregation into smallholder farmers)*

	Size in acres	Who controls this portion of land	
		1=Male, 0=Female 2=Both	1=>15-29 years, 2=30 years and above
Total land owned			
Land size under lease			
Total land under crops			
Total land under potatoes (Including leased)			

Q 2.2: POTATO PRODUCTION (Sept 2019- August 2020)

**For units for table 2.1, please use unit codes 1 below*

Season 1=SR 2019 (Sept 2019-Feb 2020) 2=LR 2020 (March-August) If the farmer has not	**Field No.**	**Crop variety code** *(See variety codes below)*	**Field size in acres**	**Type / system of watering** used 1=Rain dependent 2=Partly rain 3=Irrigated	**Seed type planted** 1=Certified seed 2=Obtained from group seed plot 3=Farmers 'own seed 4= Neighbors 5= Market 6= Others specify	**Quantity of seed used**		**Quantity harvested** *-777=not yet harvested*		If the farmer has **not harvested**, estimate the quantities likely to be harvested in this field
						Quantity	Unit	Quantity	Unit	
	Field#	**Variety**	**acres**	**Wsystem**	**Sdtype**	**Qnty**	**Q_unit**	**Hsted**	**Hunit**	**E_Harvest**

Unit codes1: 1=90 kg bag, 2=kgs, 3=50 kg bag, 4=110kg bag, 5=70kg bag, 6=10kg bag, 7=18kg bucket 8=15kg bucket 9=20kg bucket 10=100kg bag 11=120kg bag 12=150kg bag 13=180kg bag 14= Others specify

Variety codes: 1. Sherekea, 2. Kenya Mpya, 3. Asante, 4. Tigoni, 5. Shangi, 6= Dutch robjyn, 7. Unica, 8= Kenya Karibu 9= Alka, 12= Other (specify)

Q2.3

2.3a What do you consider when deciding which potato seed to grow? _____ (*use codes below*)

1= Price of seed 2= High yield 3=Resistance to diseases 4= Marketability of variety 5= Storability 6=Dormancy 7= other (Specify……)

2.3b. Do you replace your seed (Yes=1 or No=0) _____?

2.3c. If yes what is the reason for seed replacement *1= Better yield,2= Increase pest and disease resistance, 3=Advice from MoA,4=It's a routine 5=To get new variety*

2.3d. How often do you replace the seeds? *1= every season 2 = After 2 season, 3= After 3 seasons, 4= after more than 3 seasons*

Please provide the information on seed sources in the table below

Seed source name	Seed source category	Distance to seed source in Kms	Seed quantity	Unit of measurement	Price in KES

S-source category codes: *1= Certified seed merchant 2= Group multiplication site 3= Own saved seed, 4=Neighbour, 5= friends 6=Donation from MOA 7= Others specify*

2.3e. How do you rate the quality of the seed from your seed source above? *1= Very good, 2= Good, 3= Average, 4= Poor*

2.3f. Would you acquire seed from the same source mentioned if available*? 1=Yes, 0=No*

Q2.4 Production/Marketing costs: Please provide information on production and marketing costs spent on the crop planted in **September 2019 –August 2020** in table below

Season when crop was produced ***(as in Q2.2b*** 1=SR 2019 (Sept 2019-Feb 2020) 2=LR 2020 (March-August)	Field number ***(as in Q2.2b)***	Type	Qty	Unit cost	**If not purchased**, how much (KES) would you pay per unit were you to buy?	**Total***
Season	**field**	**Input (see input code)**	**Inpqty**	**inpunit**		

Costs: *1= Fertilizer, 2= Seed, 3=Fungicide 4=Pesticide 5= Labour 6= Packaging cost 7= Transport costs 8= Postharvest costs 9=Other* ***** *applicable to labour and other costs*

Q2.4 Please provide information on potato usage on the crop planted in **September 2019 –August 2020** in table below:

Season 1=SR 2019 (Sept 2019-Feb 2020) 2=LR 2020 (March-August)	**Field No**. (Fill for each field separately as in **Q 2.2**)	**Total yield**		**Proportion for Food (Units codes)**		**Proportion saved as seed**		**Proportion of quantity sold**		**Other proportional quantities**	
		Qnty	Units (Codes)	Qnty	Units (Codes)	Qnty	Units (Codes)	Qnty	Units (Codes)	Qnty	Units (Codes)

Unit codes 2:
1=90 kg bag, 2=kgs, 3=50 kg bag, 4=110kg bag, 5=70kg bag, 6=10kg bag, 7=18kg bucket 8=15kg bucket 9=20kg bucket 10=100kg bag 11=120kg bag 12=150kg bag 13=180kg bag 14= Others specify

SECTION 3

POTA Q 3.1. Did this household **sell any potato** from (Sept 2019-August 2020) **cropping year**? *1=Yes 0=No; **(If No skip to Q3.2)*** **SELLCROP**_____

Season 1=SR 2019 2=LR 2019 3=LR 2020 4=SR 2020	**Field No**	**Amount of sold**		**Average Price received** for this unit of sale	**Product type** 1= ware 2= Seed	**Buyer type** 1=Small trader 2=Large trader 3=Processor 4=Supermarket 5=Consumer 6=Broker 7=restaurants 8= Institutions 9=Other (specify)	**Why did you sell to this buyer?** 1=Only available 2=Better prices 3=Nearest 4=Contractual arrangement 5= Other (specify)
		Quantity	Unit (*use codes below)*	KES			

HHID_____

	Field	*Quants*	*Qsunit*	*Sprice*	*producttype*	*Buyer*	*Whybuyer*

Unit codes*:* 1=90 kg bag, 2=kgs, 3=50 kg bag, 4=110kg bag, 5=70kg bag, 6=10kg bag, 7=18kg bucket 8=15kg bucket 9=20kg bucket 10=100kg bag 11=120kg bag 12=150kg bag 13=180kg bag 14= Others specify

Q 3.2 If you did not sell, Why? 1= Low prices 2= Inadequate demand 3= Production meant for subsistence 4= Seed production 5= No market 6=Other _____

Q 3.3 If the response in **Q3.2** is **low price,** kindly indicate the price per unit _____ KES _____unit **(*refer to unit codes in table 3.1*)**

Q 3.4: Fill the table on the use of the proceeds from your potato enterprise **(*Use the proceeds from each field in table 1*)**

Season 1=SR 2019 2=LR 2019 3=LR 2020 4=SR 2020	Income source(field) Consider each field no. in KES	Who makes decision on the use of the income? *1=Hhead 0=Spouse 2=Both*	Amount used for food (KES)	Amount used for school fees (KES)	Amount spent on health (KES)	Amount used for other household items (Specify) (KES)	Amount reinvested in the potato (KES)	Other household uses (KES)

3.5What kind of food did you buy from the income from potato?_____ food (1) Cereals (2) Pulses (3) Milk and Milk products (4) Hotel food(junk) (5) Fruits (6) Other specify

3.6 Has the income from potato affected your purchase of foods
Yes, No
3.7 If yes, what has changed

1. I buy more nutritious/healthy foods than I was buying before
2. I buy more quantities of the foods I was buying before
3. I buy more food for the baby than I was buying when I did not have extra income
4. Other- explain

3.7 If yes, was it informed by agri-nutrition trainings received? (1) Yes, (2) No

3.8 If no, what usually informs your decisions to purchase different types of food from the income from Potato

SECTION 4.

Technologies Adoption Trainings and Information Access

Q 4.1 Did you receive training on GAPs within the learning farm? [1] Yes, [0] No

Q4.2 If yes to 4.1, how many times did you attend the training? _____times

Q4.3 Please provide information on the technology you used on potato production between **September 2019- August 2020.**

Season 1=SR 2019 2=LR 2020	**Technology**	**1=Yes, 0=No**	**If Yes, What acreage**	**Who introduced you to this technology?** 1=MOA-Learning farm 2=Neighbour 3=Friends 4= Media 5=others(specify)	**If yes** what is the sex and age of the person in charge of this technology? **(Code H)**	
					Sex	**Age**
	Positive selection					
	Seed plot technology					
	Crop rotation*					
	Certified seed					
	Quality seed multiplier					
	Pest management technology					
	Disease management					
	Apical cuttings technology					
	Hilling technology					
	Irrigation technology					

***(Code H) Age: 1=15-29 years, 2=30 years and above, 3= Mixed; Sex: 1= Male, 0=Female,* 2= Both**

**Probe on crops that were in the potato field for the last 3 previous seasons including leaving the land fallow.*

SECTION 5: DIETARY DIVERSITY

Community level nutrition education and behavior change

Q5.1 Did you receive Agrinutrition training? 1: Yes; 0: No _____

If yes, please fill the table below:

Session	Training topic	Were you trained on this topic? 1= Yes, 0=No
Session 1	Introduction to nutrition	
	Nutrients and common food sources	
Session 2	Nutrition for pregnant women	
	Nutrition for breastfeeding mothers	

Session 3	Feeding infants 0-6 months	
	Complementary feeding	
Session 4	Adolescent nutrition	
	Gender roles and nutrition	
Session 5	Food production and access	
	Appropriate technologies in food production, preparation and preservation	
Session 6	Food preparation	
	Food processing, preservation and storage	
Session 7	Appropriate sanitation and hygiene practices	
	Safe water sourcing and use for domestic use and food production	
	Total	

Q5.2 On average, how long did each/single training sessions last? _____ in minutes

Dietary diversity and Food Consumption

This section assesses Food consumption for the past 24 hours by the household (as a group) and by specific individuals:

1) Household Dietary Diversity Score – respondent: Person mainly responsible for food preparation at the household (*usually the spouse or head of household*)
2) Women's minimum Dietary Diversity Score – respondent: Female member of the household (15-49 years old)
3) Index child dietary diversity score (*6-23months*) – respondent: Mother or primary caregiver of child

Note if the child is less than 6 months, even if it is consuming solid foods (s) he cannot be considered as an index child.

The table on the following page is completed first to aid as a reminder of the food consumed in the previous 24 hours by: **the entire household** (food consumed in the home only), any **female household member and an Index child (6-23 months).**

First ask the following questions to confirm which sections of the following 2 tables will be completed:

- **Q5.3**. Is the main food preparer (or equivalent*) for the household? [ ] **(0 = No, 1 = Yes)**

If yes then complete the food consumption section for the entire household. This can also be answered by household member* who is not the food preparer but **ONLY IF** they were present in the house through the whole previous 24hrs and therefore know exactly what was consumed.

- **Q5.4**. Is there any female member of the household [ ] **(0 = No, 1= Yes)**

If yes then complete the food consumption sections for female of reproductive age. Note this female could be the mother of the index child and / or could also have been the primary person responsible for food preparation in the household.

- **Q 5.5**. Is there a child 6-23 months in the household? [ ] **(0 = No, 1 = Yes)***

- **Q 5.6**. Is the mother or primary caregiver (must be responsible for the child's feeding, with them 24hrs / day) of this child present to complete table? [ ] **(0 = No, 1= Yes)**

If yes to questions above, then complete the food consumption sections for index child. *Note* if there is a child 6-23months but the mother or primary caregiver is not there, do not ask the questions about the

child consumption because can't be sure if the information is from a knowledgeable source. If two or more children qualify to be indexed, please select the youngest child.

***Note that this first table is primarily to prompt memories (recall) of food consumed in the 24 hours before the survey AND to confirm the major ingredients in composite dishes*.**

Q 5.7 Dietary Diversity Recall (HH, Female household member, Child 6-23 months)
Please describe the foods (meals and snacks) that you ate or drank yesterday during the day and night, whether at home or outside the home (*Food taken outside home applies to female HH member and child 6-23 months*). Start with the first food or drink of the morning, write down all foods and drinks mentioned. When the respondent has finished, probe for meals and snacks not mentioned. For composite dishes (e.g. githeri – maize / beans, chapatti – cereal / oil) note down the major ingredients.
Household level: include foods eaten by any member of the household, and exclude foods purchased and eaten outside the home.

Breakfast	**Snack**	**Lunch**	**Snack**	**Dinner**	**Snack**
Entire Household *(answered by person responsible for food preparation – for only foods consumed AT HOME)*					
Female household member, including foods consumed OUTSIDE the home					
Child 6-23 months old *(question answered by primary care-giver)***, including foods consumed OUTSIDE the home**					

When the respondent recall is complete, fill in the table below, reminding respondents of the information recorded above. For any food groups not mentioned, ask the respondent (i.e. double-check) if a food item from this group was consumed.

Q 5.8 Was it a 'special' day yesterday (e.g. wedding, funeral, etc.)? [ ] **(0 = No, 1 = Yes**). If yes specify: _____

Q 5.9 Do you usually consume the potato in your household? _____ **(1. Yes, 0. No)**. If yes, how often? _____

1. Rarely
2. Once a week
3. 2-4 times a week
4. 5-6 times a week
5. Daily

ID	FOOD GROUP	***Examples*** *customise for local context always also consider other locally available food items*	***Household consumed in the last 24 hours? (No = 0, Yes = 1)***	***Source of the HH consumed food: Use codes below*** *1= Home produced 2=Purchased 3=Partly produced/Purchased* If purchased, gender of the person making this purchase *1=Male, 0= Female*	***Female HH member consumed in the last 24 hours? (No = 0, Yes = 1)***	***Child (6-23months) consumed in the last 24 hours? (No = 0, Yes = 1)***
1	CEREAL STAPLES OR FOOD FROM CEREALS	*Millet, sorghum, maize, rice, wheat, bread, noodles, biscuits*				
2	VIT A RICH VEGETABLES& TUBERS	*orange veg. pumpkin, carrot, orange fleshed sweet potato*				
3	WHITE TUBERS & ROOTS	*Potatoes, yams & sweet potato, cassava, false banana or foods made from these*				
4	DARK GREEN LEAFY VEGETABLES	*okra, spinach, sukuma wiki, managu, terere, kunde, saga, pumpkin leaves*				
5	OTHER VEGETABLES	*Tomato, onion, eggplant, cabbage, capsicum, mushroom*				
6	VIT A RICH FRUITS	*orange fruits: ripe mango, apricot, peach, papaya*				
7	OTHER FRUITS	*Apple, banana, plantain, pineapple, avocado*				
8	ORGAN MEAT (IRON RICH)	*Liver, kidney, heart, other organ meat (incl. intestine)*				

9	FLESH MEAT	*Beef, pork, lamb, goat, rabbit, wild game, chicken, other poultry*				
10	EGGS	*Eggs*				
11	FISH & SEAFOOD	*Fresh or dried fish or shellfish*				
12	MILK & MILK PROD.	*Milk, cheese, yoghurt, other products. Include milk in tea if >= 1/3rd of cup*				
13	LEGUMES, NUTS & SEEDS	*Beans, peas, pigeon peas, green grams (chickpeas), lentils, nuts*				
14	OILS AND FATS	*ANY oil, ANY butter*				
15	SWEETS	*Sweets, sugar, honey*				
16	SPICES, BEVERAGES, CONDIMENTS	*Any other foods, coffee, tea*				
How the food was mostly obtained? (Code a)						
a	Main item source (in past night and day): 1=Mainly self-produced, 2=Mainly purchased, 3=Mainly Gift, Other (specify)					

Additional Questions	
Q 5.11 Is the child breastfeeding? (0 = No, 1 = Yes)	
Q 5.12 How old is the child? (age in months)	
Q 5.13 Did the child/children ***(NAME)*** eat any solid, semi-solid, or soft foods yesterday during the day or at night? (*If '**YES**; probe what kind of solid, semi-solid, or soft foods eaten then go back to the food groups table and record foods eaten, then continue to the next question)* (Code a)	

Q 5.15 Number of times the child ate solid, semi-solid, or soft foods other than liquids yesterday (during the day or at night*)?*	
Q 5.16 If the child is no longer breastfeeding, at what age ***(in months)*** did she/he stop breastfeeding? (Code b)	
Q. 5.17 At what age ***(in months)*** did you start giving the child other foods (liquids or semi-solid)) in addition to breastfeeding? (Please verify by asking other household members): (Code c)	
a) 1=Yes, 2=No, 3=Don't know b) 77=Not applicable, 88= don't know b)77=Not applicable, 88=Do not know/Forgotten, 99 =Others	

Household location

Household GPS Coordinates:	Latitude_____ (N/S):	Longitude _____ (E/W):

Thank you

Annex 2: Questionnaire for the endline survey

Seed replacement frequency